

**IN THE CLAIMS:**

1     1.     (Currently Amended) A method of fabricating a membrane electrode assembly  
2     for use in a fuel cell, comprising:

3           (A)     providing a mold that includes a first and second mold plate adapted to  
4                    impart a desired shape to induce compression to decrease the thickness of  
5                    components in the mold and to apply pressure substantially evenly across  
6                    an entire active area of a membrane electrode assembly being fabricated in  
7                    the mold;

8           (B)     providing a lead frame, including at least a first lead frame component that  
9                    is adapted to be received into said mold, ~~wherein the lead frame includes a~~  
10                   ~~current collector with a raised surface where the raised surface provides a~~  
11                   ~~minimum limit to the thickness of components in the mold;~~

12          (C)     assembling a protonically conductive membrane with catalyst coatings on  
13                    each of its major surfaces onto said first lead frame component;

14          (D)     placing said lead frame containing said membrane into the mold;

15          (E)     compressing said second mold plate onto said first mold plate;

16          (F)     introducing a moldable material in communication with said mold plates;  
17                    and

18          (G)     allowing the moldable material to cure in said mold to solidify and form a  
19                    plastic frame around said membrane to produce a membrane electrode as-  
20                    sembly for use in a fuel cell, wherein the plastic frame holds components  
21                    of the fuel cell in compression without using screws and nuts.

1     2.     (Previously Presented) The method as defined in claim 1 further comprising inte-  
2     grating the current collector into said first lead frame component onto which said mem-  
3     brane is placed.



- 1     3.     (Previously Presented) The method as defined in claim 2 further comprising:  
2           (A)     providing a second lead frame component that includes a second current  
3                   collector; and  
4           (B)     sandwiching said catalyzed membrane between the first and second cur-  
5                   rent collectors;  
6           (C)     introducing the lead frame components into said mold;  
7           (D)     compressing the first and second mold plates together;  
8           (E)     introducing a moldable material into said mold;  
9           (F)     allowing the moldable material to cure to form the shape of the mold  
10                  plates thereby forming a sealed fuel cell.
- 1     4.     (Original) The method as defined in claim 1 wherein the step of introducing the  
2     moldable material includes injection molding a moldable material into said mold.
- 1     5.     (Cancelled)
- 1     6.     (Currently Amended) A method of fabricating a fuel cell array, comprising:  
2           (A)     providing a mold that includes a first and second mold plate of a desired  
3                   shape that forms a cavity to induce compression to decrease the thickness  
4                   of components in the mold and to apply pressure substantially evenly  
5                   across an entire active area of a membrane electrode assembly being fabri-  
6                   cated in the mold;  
7           (B)     providing a sheet of protonically conductive membrane material that has  
8                   been coated on each of its major surfaces with a catalyst material to form a  
9                   sheet of catalyzed membrane;  
10          (C)     providing a lead frame structure that includes a plurality of individual lead  
11                  frame components that define separate fuel cells, wherein each lead frame  
12                  includes a current collector with a raised surface, where the raised surface  
13                  provides a minimum limit to the thickness of components in the mold;



- 14 (D) assembling said sheet of catalyzed membrane into said lead frame struc-  
15 ture;
- 16 (E) placing said lead frame structure containing said membrane sheet into the  
17 mold;
- 18 (F) compressing said second mold plate onto said first mold plate;
- 19 (G) introducing a moldable material in communication with said mold plates;  
20 and
- 21 (H) allowing the plastic to cure in said mold to solidify and form a plastic  
22 frame around said individual fuel cells to produce a fuel cell array, wherein the  
23 plastic frame holds components of the individual fuel cells in compression with-  
24 out using screws and nuts.

1 7. (Currently Amended) A method of establishing a seal around a fuel cell, compris-  
2 ing:

- 3 (A) providing a lead frame assembly including:
  - 4 (i) providing first and second current collectors adapted to serve as lead  
5 frame components in an associated mold device, ~~wherein the first and sec-~~  
6 ~~ond current collectors each have a raised surface;~~
  - 7 (ii) assembling fuel cell components including:
    - 8 (a) a catalyzed protonically conductive, electronically non-  
9 conductive membrane; and
    - 10 (b) first and second diffusion layers disposed on opposite sides of  
11 said membrane;
  - 12 (iii) arranging said fuel cell components between said first and second cur-  
13 rent collectors;
- 14 (B) inserting the resulting lead frame assembly into a molding device;
- 15 (C) introducing a moldable material into said molding device having a mold  
16 cavity designed such so as to decrease the thickness of components in the  
17 mold ~~to a minimum limit for the thickness of components in the mold~~  
18 ~~which is set by the raised surface on the first and second current collectors~~



19 | and to apply pressure substantially evenly across an entire active area of  
20 | the membrane being fabricated in the mold; and  
21 | (D) allowing said moldable material to cure to seal the edges of the lead frame  
22 | assembly against leaks to thereby seal the fuel cell without using a gasket  
23 | and said moldable material forming a plastic frame, wherein the plastic  
24 | frame holds components of the fuel cell in compression without using  
25 | screws and nuts.

1 8. (Previously Presented) The method as defined in claim 7 further comprising spot  
2 welding the first and second current collectors that serve as lead frame components to-  
3 gether to maintain the components in place.

1 9. (Previously Presented) The method as defined in claim 7 further comprising trim-  
2 ming excess lead frame component portions away from said fuel cell to result in a fin-  
3 ished fuel cell.

1 10. (Previously Presented) The method as defined in claim 7 further comprising pro-  
2 viding said mold device with a mold cavity which, when said moldable material is intro-  
3 duced into said mold cavity and cured, creates a frame around said fuel cell.

1 11. (Currently Amended) A method of establishing a sealed diffusion layer for use in  
2 a fuel cell, comprising:

3 (A) providing a first current collector integrated into a lead frame component,  
4 wherein the first current collector includes a raised surface;

5 (B) applying a diffusion layer material to said first current collector on  
6 said lead frame component;

7 (C) providing a second current collector integrated into a lead frame compo-  
8 nent;

9 (D) applying a second diffusion layer material to said second current collector  
10 on said lead frame component;



- 11 (E) placing a catalyzed protonically conductive, electronically non-conductive  
12 membrane between said first lead frame component and said second lead  
13 frame component to form an assembly;
- 14 (F) placing said assembly into a molding device;
- 15 (G) closing mold plates associated with said molding device and hot pressing  
16 the assembly for a predetermined time period to decrease the thickness of  
17 components in the mold ~~to a minimum limit for the thickness of compo-~~  
18 ~~nents in the mold which is set by the raised surface on the first current col-~~  
19 ~~lector and to apply pressure substantially evenly across an entire active~~  
20 area of a membrane electrode assembly being fabricated in the mold;
- 21 (H) introducing a moldable material into said mold cavity of said mold device;  
22 and
- 23 (I) allowing said moldable material to cure to seal said lead frame compo-  
24 nents integrating said first and second current collectors together to form a  
25 fuel cell, wherein said moldable material forms a plastic frame and the  
26 plastic frame holds components of the fuel cell in compression without us-  
27 ing screws and nuts.

1 12. (Original) The method as defined in claim 11 wherein step (H) includes an insert  
2 molding technique.

1 13. (Previously Presented) The method as defined in claim 11 further comprising  
2 spot welding said first and second lead frame components together to maintain said com-  
3 ponents in position prior to placing the assembly into the molding device.

1 14. (Currently Amended) A method of introducing compression into a fuel cell, com-  
2 prising:

- 3 (A) providing a catalyst coated membrane;
- 4 (B) providing a first current collector integrated into a first lead frame compo-  
5 nent suitable for being received into a molding device, wherein the first



- 6 | ~~current collector includes a raised surface where the raised surface pro-~~  
7 | ~~vides a minimum limit to the thickness of components in the mold;~~
- 8 (C) providing a second current collector integrated into a second lead frame  
9 component suitable for being received into a molding device;
- 10 (D) assembling said first and second current collectors on either side of said  
11 membrane to result in an assembly;
- 12 (E) placing said assembly into said mold device that has been provided with  
13 mold plates that form a cavity that induces compression to decrease the  
14 thickness of components in the mold and to apply pressure substantially  
15 evenly across an entire active area of a membrane electrode assembly be-  
16 ing fabricated in the mold;
- 17 (F) closing said mold plates and maintaining said mold plates in a closed posi-  
18 tion to induce further compression; and
- 19 (G) introducing a moldable material into the resulting mold cavity thereby cre-  
20 | ating a plastic frame around the fuel cell that maintains compression  
21 within said fuel cell without the need for mechanical fasteners.

1 15. – 21. (Cancelled)

1 22. (New) A method of fabricating a membrane electrode assembly for use in a fuel cell,  
2 comprising:

3 providing the membrane electrode assembly having a proton exchange membrane,  
4 wherein the proton exchange membrane is configured with an anode aspect and a cathode  
5 aspect;

6 providing an anode side component of a lead frame, with the anode side compo-  
7 nent of the lead frame having an anode current collector;



8 providing a cathode side component of the lead frame, with the cathode side com-  
9 ponent of the lead frame having a cathode current collector;

10 connecting the anode side component of the lead frame to the cathode side com-  
11 ponent of the lead frame with the membrane electrode assembly sandwiched between to  
12 form a lead frame assembly;

13 placing the lead frame assembly within a mold cavity;

14 closing the mold cavity, wherein the fuel cell is compressed to a predetermined  
15 thickness dictated by a desired internal pressure; and

16 injecting plastic around the membrane electrode assembly to form a plastic frame,  
17 where in the plastic frame holds components of the fuel cell in compression without using  
18 screws and nuts.

1 23. (New) The method of claim 22, further comprising:

2 trimming excess material from the lead frame structure away to leave only the  
3 fuel cell with current collectors extending outward.

1 24. (New) The method of claim 22, further comprising:

2 providing one or more anode diffusion layers between the anode current collector  
3 and the anode aspect, wherein the one or more anode diffusion layers are employed to



4 evenly distribute a liquid fuel mixture across the anode aspect of the proton exchange  
5 membrane; and

6 providing one or more cathode diffusion layers between the cathode current col-  
7 lector and the cathode aspect, wherein the one or more cathode diffusion layers allows a  
8 fast supply and even distribution of gaseous oxygen across the cathode aspect of the pro-  
9 ton exchange membrane.

1 25. (New) The method of claim 22, wherein the anode current collector, the cathode cur-  
2 rent collector, and the proton exchange membrane are each configured with a plurality of  
3 openings that allow plastic to flow through to form a plurality of internal fasteners.